COOPERATIVE AGREEMENT

BETWEEN

The Micro Autonomous Systems and Technology (MAST) Consortium

AND

U.S. Army Research Laboratory (ARL)

CONCERNING

The Micro Autonomous Systems and Technology (MAST)
Collaborative Technology Alliance (CTA)

Agreement No: W911NF-07-2-

Total Estimated Amount of the Basic Agreement:	$
Total Estimated Government Funding of the Basic Agreement:	$
Total Estimated Recipient Cost Share of the Basic Agreement:	$
Total Estimated Amount of the Option:	$
Total Estimated Government Funding of the Option:	$
Total Estimated Recipient Cost Share of the Option:	$

Government Funds Obligated: $
Authority: 10 U.S.C. § 2358

CLIN 0001 is hereby established in the amount of $_____. Additional CLINs may be established, subject to the availability of funds, up to the Total Estimated Amount of the Agreement set forth above.

Accounting and Appropriation Data:

ACRN AA:	
Appropriation No.:	
Requisition No.:	
Amount:	
Applicable CLIN:	

This Agreement is entered into between the United States of America, hereinafter called the Government, represented by the **U.S. Army Research Laboratory (ARL)**, and **the MAST Consortium**, pursuant to and under U.S. Federal Law.

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

PRINCIPAL MEMBER FOR INTEGRATION (CONSORTIUM LEAD)

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

GENERAL MEMBER FOR INTEGRATION

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

PRINCIPAL MEMBER FOR MICROSYSTEM MECHANICS

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

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GENERAL MEMBER FOR MICROSYSTEM MECHANICS

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

PRINCIPAL MEMBER FOR PROCESSING FOR AUTONOMOUS OPERATION

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

GENERAL MEMBER FOR PROCESSING FOR AUTONONMOUS OPERATION

_____
(Signature)

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(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

PRINCIPAL MEMBER FOR MICROELECTRONICS

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

Signature of one person for each member of the MAST Consortium, authorized to bind that organization under this Cooperative Agreement

GENERAL MEMBER FOR MICROELECTRONICS

_____
(Signature)

_____
(Name)

_____
(Title)

_____
(Name of Organization)

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ARTICLE 1 SCOPE OF THE AGREEMENT

1.1 Introduction

This Agreement is a "Cooperative Agreement" (31 U.S.C. § 6305) and is awarded pursuant to 10 U.S.C. § 2358 Research Projects. The Parties agree that the principal purpose of this Agreement is for the Recipient to provide its best research efforts in the support and stimulation of fundamental research and not the acquisition of property for the direct benefit or use of the Government. FAR and DFARS apply only as specifically referenced herein. This Agreement is not intended to be, nor will it be construed as, by implication or otherwise, a partnership, a corporation, or other business organization.

1.2 Background And Vision Statement

New realities demand innovative concepts to focus the talent of industry and academia on critical technology needs of the Army. Ten years ago the Army Research Laboratory (ARL) responded to the challenge by changing the way it did business. The new strategy focused in-house laboratory research on Army-specific business areas while establishing extramural centers of research in areas where state-of-the-art expertise could be leveraged to satisfy Army technology needs. The combination of government in-house, industry, and academic components striving together for excellence created a new paradigm for Army research -- a "federated laboratory". The FedLab concept proved to be an overwhelming success, a "win-win" situation for all concerned – ARL, the private sector consortia members, and the Army system developers. It was awarded the Hammer Award for Reinventing Government by former Vice President Al Gore.

The CTA Program is the follow-on to the FedLab Program and, on 31 May 2001, and as a result of a competitive process, ARL established five CTAs in the areas of Advanced Sensors, Power & Energy, Advanced Decision Architectures, Communications & Networks, and Robotics. The proposed MAST CTA is modeled after these CTAs and continues the paradigm of collaborative work involving government, industry, and academia. ARL's strategy is to continue exploiting technology and expertise where it exists through the issuance of this cooperative agreement to an industrial and academic consortium that will work with ARL scientists and engineers to help fulfill critical military modernization objectives.

ARL and the Consortium, will establish one collaborative research Alliance to address issues concerning MAST including Microsystem mechanics, processing for autonomous operation, microelectronics, and integration. The objective of the Alliance is to enhance tactical situational awareness in urban and complex terrain by enabling the autonomous and semi-autonomous operation of a collaborative ensemble of multifunctional, mobile microsystems.

1.3 Scope

Operations Enduring Freedom and Iraqi Freedom have demonstrated the value of robotic platforms, both aerial and ground, that are teleoperated remotely. Robotic platforms extend the warfighter's senses and reach and have been used as sensor, communications, and, in some instances, weapons platforms. Especially in complex terrain, like caves and mountains, or an urban environment, these platforms provide operational capabilities to the warfighter that would otherwise be costly, impossible, or deadly to achieve.

Future enhancements to warfighting capabilities require a reduction in platform size and the cohesive operation of multiple platforms. A reduction in the size of the platform increases capabilities by allowing warfighters to carry multiple platforms. However, teleoperation of multiple platforms by a single operator increases the burden on the operator without necessarily improving operational effectiveness. For that reason, it is necessary for the platforms to operate autonomously to some extent.

The objective of the MAST CTA is to enhance tactical situational awareness in urban and complex terrain by enabling the autonomous operation of a collaborative ensemble of multifunctional, mobile

microsystems. The length-scale of the microsystems is approximately 30 cm or less and the platforms are lightweight, ca. 500 g or less. To achieve this objective the Alliance is expected to produce advances in fundamental science and technology, demonstrate and transition technology, and develop research demonstrators for warfighter experimentation.

Some degree of mobility is critical to the operational effectiveness of the collection of platforms. This includes, but is not limited to, flying, crawling, walking, and jumping. Consider, for example, a small unit searching a building for potential human threats. The platforms are emplaced or launched initially by the unit but their movement is guided by perceived improvements in situational awareness provided by modifying the platform distribution. Thus, determining waypoints, as well as stable controlled movement between waypoints is critical. The ability to hover or perch is also advantageous to operations. Through their movement the platforms develop a map of the building interior which is transmitted to the operational (human) unit. The map may indicate the location of potential threats and it may also be annotated by imagery.

Similar capabilities are also required when searching caves or demolished buildings, but the terrain is more complex to map and to navigate. Paths are irregular and ground surfaces are no longer smooth. Air flow may be gusty. In caves, especially, the lack of ambient lighting and the thermal uniformity of the environment complicate navigation.

Surveillance of a wide area for perimeter or asset defense is an alternative scenario that requires full autonomy from a collection of microsystems. Not only must the collection provide situational awareness, it must also respond in some manner (lethally or non-lethally) prior to human intervention. Thus, the requirements on processing to understand and respond appropriately are increased over those of the small unit search.

Enabling the capabilities reflected in the three search and surveillance scenarios above requires the solution of fundamental technical issues in several key areas including: aeromechanics and ambulation; electrical power and propulsion; sensing, processing, and communications; navigation and control; mobile, distributed sentience; microdevices and heterogeneous integration of materials; platform packaging; and systems architectures. However, the impact and interplay between conflicting requirements on these technical issues are so complex that investigating a single issue in isolation of the others will not generate an efficient and operationally effective ensemble of microsystems.

To appreciate system constraints most fully one should consider the problem as providing mobility to a sensor network as opposed to miniaturizing an unmanned system. Solutions to processing, communications, and mobility, for example, that are satisfactory for large systems do not scale when platforms are reduced to the size considered in this CTA. For example, platform size and weight limit the power available over the duration of a mission. The largest percentage of available power is utilized for mobility. The limited power in turn constrains the bandwidth of intra-platform communications, e.g., between sensors and processors, processors and transmitters, as well the bandwidth of inter-platform communications, and limited communications impact the ability of the microsystem collective to sense, understand, and respond coherently as a group.

Further, the interfaces, both physical and metaphorical, between components become more significant as one attempts to integrate functionality and reduce scale. In one respect a thin physical interface between two components is more desirable than a cable or a wire. But insuring the continuity of physical parameters across small junctions, small apertures, or other boundaries becomes difficult. If designed poorly, the interface can result in unacceptable losses that negate the advantages of integration.

One must also be cognizant of the fact that the attraction of small, integrated systems belies the existence of a large infrastructure to maintain it. The reliance upon cell towers and a local power grid is not apparent when one uses a cell phone. But without the towers and power grid, it is not possible to establish a telephone circuit or recharge portable devices. Similar issues related to infrastructure are certain to arise when creating a network of microsystems. The dependence of a collection of microsystems on macro-infrastructure should be considered.

The Consortium is organized as three Centers for research and an integration effort, led by four Principal Members; however the key to developing microsystem technology is to consider the interplay between all of

these. Radical design and engineering methodologies are envisioned in which system-level performance, maneuvering, and functional adaptability are emphasized over the optimization of individual functions. Particularly exciting multidisciplinary themes that could potentially represent breakthrough technologies for microsystem applications include:

- Bio-inspired or bio-mimetic materials and devices for mobility, navigation, and control
- Active materials with embedded sensors for mobility, navigation, and control
- Multifunctional materials and structures, for example, to provide structural integrity and mission functionality
- Computational sensing to reduce power required to process data into information

ARL acknowledges that the focus of the research may change during the period of performance. Therefore, ARL reserves the right to withhold up to 10% of annual funding for the MAST CTA provided to ARL through the appropriation process to fund novel research projects under the scope of this Agreement . These novel research projects are expected to be funded under this Agreement, and these projects may be proposed and performed by Consortium members, as well as entities not currently members of the Consortium.

1.4 Goals

The following represents a discussion of the three research Centers and the effort associated with Integration.
NOTE: At least 10% of the funding for the research Centers must be provided to HBCU/MI Member(s).

Center on Microsystem Mechanics

Research in this technical focus area will develop a fundamental understanding of mechanics for small unmanned air and ground vehicles as needed to obtain desired mobility objectives. These objectives span across the disciplines of aeromechanics, ambulation, and propulsion; with the aeromechanics discipline focused on key elements of microsystem flight, the ambulation discipline focused on key elements of microsystem ground movement, and the propulsion discipline focused on the overall process of taking energy from a fuel source and converting it into useful mechanical motion. The research pursued in these disciplines should build the foundations of new microsystem technologies that expand maneuvering capabilities at the extremes of the anticipated operational environment. This includes maneuvering in both confined environments such as building interiors, tunnels, and caves, and unconfined environments such as a battle zone perimeter defense. The need to maneuver over obstacles, through rough terrain, and within gusty wind conditions are important considerations for this research as shall be discussed further in this section.

One technical issue of importance to platforms of this size class is stability and control in a large-disturbance environment. Thus, for example, a small unmanned aerial vehicle can be expected to encounter atmospheric gust disturbances whose length and velocity scales are of the same order of magnitude than those of the vehicle itself. Small unmanned ground vehicles can also be expected to negotiate obstacles whose size is a considerable fraction of that of the vehicle itself, without tipping over. These situations can be exacerbated because the disturbance input is often at frequencies comparable to that of the platforms own natural frequency. Traditional linear vehicle stability and control approaches may be insufficient for this application owing to the inherent nonlinear mechanics dominating the vehicle response. An attractive approach for vehicle maneuverability is the use of bio-inspired or biomimetic legs and wings, as nature has provided these examples of successful solutions to micro-scale systems operating in a large disturbance environment.

With respect to aeromechanics, flapping wing flight motivated by invertebrates and small birds appears more energy-efficient and gust-tolerant at these sizes than conventional fixed and rotary wing designs. The understanding of the aerodynamics of the clap and fling mechanism that characterizes flapping wing flight is not adequately understood because no analytical theory of unsteady, low Reynolds number vortex-dominated aerodynamics is currently available. The aeroelastic wing response needs to involve the efficient coupling between massive flow separation and highly-flexible structures. In addition, the role of wing deformation in invertebrate flight control is not well understood.

Research associated with small-scale rotary-wing and other more traditional forms of flight is required for a complete understanding of microsystem aeromechanics. Such research should emphasize the application of fundamental laws of fluid mechanics to define a role for this approach that satisfies anticipated constraints on propulsion and weight. Energy-based performance comparisons between traditional and flapping-wing flight mechanics may be extremely useful in guiding the emphasis and focus of future research in aeromechanics.

With respect to ambulation, small walking ground vehicles have already demonstrated the ability to traverse relatively large obstacles. Further study is required to characterize and improve the performance of biomimetic leg systems with respect to various surfaces and terrains. For a particular terrain, new and unique ambulation concepts should be optimized for weight, economy, and speed. There is a need to develop a fundamental understanding of the influence that key design parameters, such as material stiffness, joint size/location, structural weight, and characteristic lengths, have on ambulation performance. Improved analytical capabilities that combine formulations of multibody dynamics, elasticity, and contact constraints are required to perform accurate studies and assessments of advanced ambulation concepts.

Furthermore, ambulation via biomimetic appendages cannot be considered independent of the actuation system. While qualitative studies have been performed, more rigorous efforts that quantify the capability of various actuation approaches to mimic natural muscle with respect to strain, density, efficiency, speed, damping, and stiffness would be noteworthy.

Distributed and integrated propulsion concepts represent another key focus of this research. Efforts are encouraged that help define the relative performance of centralized propulsion mechanisms (traditional vehicle approach) versus distributed propulsion systems (energy conversion at the point of actuation) versus hybrid propulsion systems (part-centralized and part- distributed as exemplified by biological systems). While range and endurance requirements of microsystems may be low compared to traditional classes of vehicles, the reduced operational efficiency encountered at micro-scales is expected to put a significant burden on stored energy resources, inspiring a need to develop new propulsion systems that include unconventional methodologies for energy conversion.

For example, flapping and walking motion are generally more effective using cyclic linear motion, as opposed to rotary motion that has traditionally been used for larger vehicle propulsion. A great deal is known about high efficiency electrical motors, but no high-force, high-bandwidth large-displacement *linear* actuators currently exist that can efficiently propel flapping or walking vehicles of this size class. Such actuators could involve electrical-to-linear force conversion, but it may be advantageous to consider direct chemical-to-linear force actuation.

Center on Processing for Autonomous Operation

Research is needed to provide the fundamental underpinnings for autonomous operation of distributed, mobile, multi-modal sensing micro-systems. These systems must operate under severe constraints on power and energy, and communications bandwidth, while achieving networked systems-wide goals. Nodes must be controlled at the individual and group level, adaptively navigate in a non-benign environment, and cooperate in groups, in semi- and full autonomy. Multi-modal sensing and distributed signal processing are needed that efficiently extract information, for both intra and inter-node communication, and to support mobility, communications, and surveillance. Artificial intelligence, capable of learning and adapting, should enable the individual and group goals. Underlying communications modalities should balance power and system performance, incorporate integrated communications and sensing, and operate robustly in non-benign environments. Communications networks should provide the foundation for the systems distributed adaptive mobile operation, including heterogeneous nodes, asymmetric networking and control, and interfacing with the macro world including humans and larger platforms.

Particular emphasis should be placed on developing analytical frameworks, modeling and simulation techniques, and experimental methods that are tightly coupled and support the overall micro-systems goals. The developed methods must address autonomous behavior and intelligence; the sensing and communications techniques and associated system architectures; the integration of actuation control with

sensing, communications, and mobility; and fundamental limits and performance tradeoffs under communications and power/energy constraints.

Center on Microelectronics

To enable power efficient multi-functional sensing, ambulatory control, and reconfigurable networked response in mobile micro-scale platforms advancements are necessary in the areas of *novel* electronic, electro-optic, and electro-mechanical devices, circuit architectures, and materials. The constraints of small size and limited power require the development of simple but robust concepts that employ approaches beyond standard microelectronics circuitry and systems operation. For example, mixed signal (combined analog and digital) information processing and communication, and the investigation of bio-mimetic circuit architecture approaches may be necessary to enable functionality within the limits of power and thermal management. A wide variety of sensors will be required both for the mobile, networked microsystem platform and the payload that it carries. The need for low power, stable oscillators is envisioned to enable duty cycling for both electronic processing and communications, and to support geolocation for mobile robotic systems. Antennas and other transmit/receive concepts operating at frequencies outside of the conventional radio frequency spectrum may be required for short distance communication between platforms, and the unique electronics challenges of multi-scale communications must be identified and resolved. These may include the development of practical low-power switchable filter banks to enable networked communication at multiple length scales. Novel signal processing approaches may be required to enhance the selectivity of sensors and reduce false positive readings, as well as distill essential information to reduce transmission power and enhance response efficiency.

Smart materials that exhibit multifunctionality may enable sensing, mobility, and communications objectives. Significant advances in the nanoscale engineering of materials and physical mechanisms may be required to achieve the structural, optical and electronic properties in such materials and enable low-power functionality. For example, resonant behavior suitable for filtering can be realized by patterning a dielectric as an artificial crystal. Heterogeneous integration, including the investigation of atomic interfaces, will likely be required to form useful structures or devices with reliable and robust performance. For example, piezoelectric materials may be employed as or integrated into structural components such as flapping wings or vibratory/resonant structural components to capture and convert the dynamic mechanical energy into electrical energy to power sensors located on or near those components.

Concepts for integrating power management or generation at the device, circuit, or sub-system level should consider distributed versus localized strategies, as well as management of associated duty cycles which may be optimized across varying mission scenarios to ensure the appropriate and efficient use of power that features a prioritized scheme.

An investigation of the fundamental physical limits of relevant electronic, mechanical, optical, and structural issues should be considered in the context of potential trade-offs in operational performance. These include, but are not limited to, sensed information processing, signal filtering, transmission, and receipt at relevant length scales, impedance matching, and noise sources within system-level size, weight, and power constraints which are expected to be severe and endemic. The need for radical design and engineering methodologies is envisioned in which system-level performance, maneuvering, and functional adaptability are emphasized over the optimization of individual functions.

Effort in this area should be tempered and driven by the following pervasive concepts: novel and autonomous application-specific technologies will be needed; the integration of materials, devices, and components must be multi-scaled and multi-level; and modeling, simulation, and performance analysis must accompany, shape, and interpret experimental progress.

Integration

Integration and experimentation are the keystones to generating empirical data, providing feedback to Principal Members, and insuring the design process is iterative. As the Lead for the Consortium, the Principal Member for Integration has primary responsibility for articulating and executing a vision on

cross-Consortium integration. The Lead is expected to integrate the disparate technologies delivered by the Centers for experiments and to guide Center investigations based on collected data. The Lead is therefore responsible for coordinating crosscutting themes with Principal Members

To achieve the capabilities described in the operational scenarios, a designer needs to understand and exploit the inter-platform and intra-platform interactions and efficiencies in a collaborative ensemble of microsystems. Successful demonstration of operational capabilities requires radical design and engineering methodologies in which system-level performance is emphasized over the optimization of individual functions.

Successful integration requires an over-arching architecture for the collection of microsystems and the functionality of each platform. Challenges to establishing this architecture include balancing traditional goals of function, performance, and cost against non-traditional engineering goals such as flexibility, robustness, scalability, and sustainability. Further, it is necessary to understand the relationships or trade-offs between goals, system characteristics, and physical structure, e.g., performance vs. flexibility trade-offs. Critical to microsystem technology is that platform size, weight, and power dictate solutions that are not scaled versions of larger platforms.

To achieve the required understanding to define a microsystem architecture one may have to determine fundamental physical limits, define parametric representations of systems and subsystems, model system and subsystem interactions, develop design tools to examine tradeoffs, or develop scalable system design. Achieving fundamental understanding requires input from the Centers as does designing reliable experiments to validate parametric representations and models, or to test assumptions on single and multiple platforms.

A fundamental challenge is balancing modularity against integration. The needs and priorities for integration should be guided by anticipated gains in mission capabilities and should outweigh benefits gained through modularity. This will dictate whether it is best to design a special purpose platform versus one that has plug-and-play payloads, or whether it is better to design a module to have multifunctionality or optimize its performance for a single function.

Given the significant constraints placed upon microsystems-based platforms with regard to scale and payload capability, efficiencies in size and weight for all integrated components are key drivers for achieving the associated mission technical objectives with a minimum of weight and scale. The development of functional packaging concepts (e.g., the design and use of husks that serve as structural protection in transit but may deploy on-site for increased platform stability and/or support for sensor arrays), as well as the material-based efficiencies that may be realized through direct integration with the platform, are considered vital areas of focus for achieving improvements in integration efficiencies.

An example of the efficiencies envisioned include shifts or redistribution of material associated with sensing and electronic payload into structural platform components to achieve a desired benefit in power to weight ratios with a concomitant improvement in sensing capability (e.g., higher power, longer endurance). Integration concepts should further consider biomimetic or bio-inspired systems strategies that may offer enabling technologies for engineered microsystems by virtue of their efficient structural shapes, materials, and multi-functional designs, and how these natural designs facilitate specific performance objectives for the given mission of the system. However, such structural efficiencies need to be balanced by the negative effects of high density, heterogeneous integration such as the generation of heat.

1.5 Objectives

The Recipient shall participate in a program of coordinated research, development, and education with ARL in accordance with the Program Plans to be included in this Agreement, which set forth the specific goals and objectives for performance under the Agreement. The recipient shall also comply with the reporting requirements set forth in Attachment 6.

The Government will have continuous involvement with the recipient. The Government will also obtain access to the research results and certain rights in data, computer codes developed, and patents pursuant to Article 10 and Attachments 1 and 2 to this agreement. The Government and the Recipient are bound to each other by a duty of good faith and best research effort in achieving the goals of the Program.

As a condition of this Agreement, it is herein understood and agreed that Federal funds are to be used only for costs that: (1) a reasonable and prudent person would incur, in carrying out the advanced research project herein; and (2) are consistent with the purposes stated in governing Congressional authorizations and appropriations.

ARTICLE 2 GENERAL DEFINITIONS

2.1 Recipient – An organization or other entity receiving a grant or cooperative agreement from a DoD Component. For purposes of this Agreement, the Recipient is the MAST CTA Consortium.

2.2 Party – For purposes of this Agreement, the parties are ARL and the Recipient.

2.3 Cooperative Agreement Manager (CAM) – Is the Government's technical representative from ARL charged with the overall technical management and fiscal responsibility for the Agreement. The CAM is identified at Article 3.1.

2.4 Program Director – The Program Director is the Consortium's technical representative charged with the Consortium's overall responsibility for management of the Agreement. The Program Director will be from the organization named as the Principal Member for Integration. The MAST CTA is expected to be the primary responsibility of the individual assigned as Program Director, and a commitment of time commensurate with this responsibility is also expected. The Program Director is identified at Article 3.2.

2.5 Center Directors - Each research center will have a Center Director. The Center Director is the Center's technical representative charged with the Center's technical leadership, management, and guidance. The Center Directors are identified at Article 3.3.

2.6 Grants Officer – Is the Government's principal point of contact for all administrative, financial or other non-technical issues arising under the Agreement. The Grants Officer has the authority to enter into, administer or terminate the Agreement The Grants Officer is identified at Article 8.1.

2.7 Agreements Administrator – The Agreements Administrator has authority to administer Cooperative Agreements and, in coordination with the Grants Officer, make determination and findings related to delegated administration functions. The Agreements Administrator is identified at Article 8.2.

ARTICLE 3 PROGRAM MANAGEMENT

3.1 The ARL Cooperative Agreement Manager (CAM) is:

3.2 The Members of the Consortium include:

3.3 The Program Director is :

3.4 The Center Directors are:

3.5 Overall Management Concept: ARL and the Consortium will establish one collaborative research Alliance to address issues concerning the MAST CTA. Additionally, other Government agencies may be invited to join this Alliance and to contribute, as appropriate, their technical expertise and personnel, and to participate in the MAST CTA. Each Principal Member will be responsible for technical leadership in their respective research area, in coordination with the other Principal Members. The Principal Member for Integration is responsible for the overall management of the Consortium.

3.6 Management and Program Structure – The CAM will be responsible for the management and integration of the collaborative efforts under this Agreement including programmatic, technical and reporting.

3.7 A **Technical Management Group (TMG**) is chaired by the CAM and consists of the Program Director, the three Center Directors, as well as the corresponding Government technical leads. The TMG will assist the CAM and the Program Director in carrying out their duties concerning the MAST CTA.

3.8 Technical Guidance and Oversight: The Alliance will be subject to the following technical guidance and oversight:

- An **Executive Steering Board (ESB)** will be established to address issues of US Army policy with respect to the MAST CTA's work. The ESB will include senior level Army personnel, who will meet annually to review the overall program and progress of the MAST CTA and provide macro level guidance on the direction of the program.

- A **Research Management Board (RMB)** will be established to identify and develop collaborative opportunities, advise and assist the CAM in setting research goals, and facilitate transition to development programs. The RMB will include representatives from Army and other service organizations and other government agencies with interest, expertise, or both in technologies related to the MAST CTA. The RMB will be invited to the Annual Conference and the Annual Technical Review, and be informed about the Annual Program Plan approval process.

3.9 Consortium Management Committee (CMC). The CTA will have a Consortium Management Committee (CMC) that consists of one representative from each Principal and General Member. The CAM participates as ex officio member in all discussions except those that deal with purely internal Consortium matters. The CMC will be chaired by the Program Director. Each Principal Member will have one vote on the CMC to support programmatic and management-related activities and decisions. General Members are expected to be active participants in the CMC, but they do not have a vote. General Members are to be represented on the CMC for voting purposes by the Principal Member in the area under which they are a General Member. However, the Principal Member may select a proxy from among the General Members it represents to cast a vote when the Principal Member is unable. In the event of a tie, the Principal Member for Integration will cast the deciding vote. The CMC will be responsible for the management and integration of the Consortium's efforts under the MAST CTA including programmatic, technical, monitoring, financial and administrative matters. The CMC makes recommendations that concern the membership of the Consortium, the definition of the tasks and goals of the participants, and the distribution of funding to the participants. Quarterly meetings will be conducted by the CMC.

3.10 Initial Program Plan (IPP) and Annual Program Plan (APP). Within 90 days after award, the Consortium (through the CMC) and the Government will jointly prepare an Initial Program Plan (IPP) to cover the first 12 months of performance. The IPP will be based substantially on the final proposals received by each of the four Principal Members prior to award of the Cooperative Agreement. Each of the Principal Members will share their proposed portion of the IPP with the other Principal Members. Through discussion among the Principal Members, an IPP will result that enables integration and execution of

crosscutting themes that strive to achieve MAST CTA objectives. The IPP will be accompanied by a five-year roadmap that describes the overall plan to be accomplished by the Consortium within the Alliance structure. This roadmap should provide the vision for grand challenges and crosscutting themes to be addressed in the first five years. The roadmap should provide a detailed description of a well-coordinated theory and experimental program for the first two years; it should present and justify an appropriate balance between theory and experiments. The CAM will approve the IPP and formally submit the approved IPP to the Grants Officer for incorporation into the cooperative agreement.

Eight months after award, the Consortium (through the CMC) and the Government will jointly prepare a proposed Annual Program Plan (APP) for the next annual period. As in the case of the IPP, each of the Principal Members will prepare their proposed portion of the APP and share such with the other Principal Members. Through discussion among the Principal Members, an APP will result that enables integration and execution of crosscutting themes that strive to achieve MAST CTA objectives. The ESB will provide guidance on the research directions of the Consortium to support US Army future forces requirements. The CAM will approve the APP and formally submit the approved APP to the Grants Officer for incorporation into the cooperative agreement. This process will continue through the life of the cooperative agreement.

The IPP/APPs will cover a one-year timeframe, but may be altered, with the approval of the CAM and the Grants Officer, if research work requirements change. The IPP/APPs will provide a detailed plan of research activities (including key personnel, educational opportunities, staff rotation, facilities, demonstrations and budget) that commits the Consortium to use their best efforts to meet specific research objectives. The IPP/APPs will also describe the collaborative efforts with the Government. The IPP/APPs constitute the necessary "statement of work" and authorization document for each research project or task expected to be executed in the ensuing year. The IPP/APPs will include a budget that will include the sum of both Federal and non-Federal shares, as appropriate and the expected distribution of same. During the course of performance, if it appears that research goals will not be met, the CMC will provide a proposed adjustment to the IPP/APPs, in coordination with the TMG, for approval by the CAM. In addition, the CAM may from time to time request that additional research be added to the IPP/APPs within the scope of the Agreement. The Consortium, as an entity, will not solicit or accept funding from outside sources other than ARL without the approval of the CAM and the Grants Officer.

3.11 Annual Conference

The Consortium will be responsible for participating with ARL in an Annual Program Formulation Conference to display and present the results of its previous year's research and describe plans for the next year. Program overviews, posters, and exhibits and demonstrations will be presented, displayed, or both to communicate the research products of the MAST CTA. The Conference will foster interactions and collaborations among researchers. Planning for the Conference will be executed through the Principal Member for Integration (Consortium Lead) and the CAM.

3.12 Evaluation For Five-Year Extension

This Agreement contains an option for a potential five-year extension to the period of performance under this Agreement. At the end of the fourth year of performance, a program review will be conducted as directed by ARL. This review will consider cumulative performance metrics, the Consortium's vision for the additional five-year period of performance (to be submitted by the Consortium at the end of the fourth year), funding availability and the current fundamental research needs and goals of the US Army. Performance metrics are expected to include items that provide an indication of the MAST CTA's accomplishments, such as transitions, the number of refereed journal articles, invited presentations, relevance of the work to ARL, collaboration, staff rotation, education, management, etc. The decision as to whether to exercise the option is expected to be based on the results of the review and evaluation described above.

3.13 Collaboration Environment

The Principal Member for Integration (Consortium Lead) must provide an environment that promotes the collaborative research and management of the Alliance. Such an environment might be a web-based, password-protected system. The Consortium Lead will provide an Internet secure environment for information sharing and interactive collaboration. An information repository will be maintained where ongoing research results, published papers and reports, biennial research plans, interactive file sharing, discussion groups, interactive calendars of events, and other information can be accessed to enhance communication. This environment should support collaboration among Consortium members and between the Consortium and the Government and should support multi-level access control to protect sensitive information and intellectual property. The Consortium is expected to facilitate the integration and demonstration of integrated Alliance research results through this collaboration environment.

3.14 Tracking Technology Transfer

While it is expected that each Principal Member will actively pursue technology transition to the Government as part of executing the Fundamental Research Component, it will be the responsibility of the Consortium Lead to briefly document and report to the Government on technology transition opportunities and events as they result from the research being performed under this Agreement.

3.15 Distribution of Funding

The Consortium Lead will distribute the funding under this Agreement to all members (i.e. Principal and General) of the Consortium. Subawardee funding will be provided to the Consortium Member with which the Subawardee has or will have a legal relationship. ***NOTE: At least 10% of the funding for the research Centers must be provided to HBCU/MI Member(s).***

3.16 Federally-Funded Research and Development Centers (FFRDCs)

FFRDCs that participate under this Agreement must provide cost-share in an amount equal to the funding being provided to them under this Agreement.

ARTICLE 4 STAFF ROTATION AND ON-SITE COLLABORATION

4.1 Salary and Travel Costs. All salary and travel costs associated with the rotation of government personnel will be borne by the Government. All salary and travel costs associated with staff rotation or on-site collaboration of Recipient personnel will be paid for with funding provided under this Agreement.

4.2 Host Facility Regulations. All personnel in rotational assignments or on-site collaboration are required to comply with the safety, environmental, security, and operational regulations or requirements of the host facility.

4.3 Administrative Support. The host facility will provide adequate office space, communications connections, administrative support, and office supplies, if available, for researchers in long-term rotational assignments. Should it become necessary to procure equipment to facilitate a rotational assignment, the APP should reflect the need for said equipment, and the costs will be borne under the cooperative agreement.

ARTICLE 5 FISCAL MANAGEMENT

5.1 Restrictions on the Use of Government Funds. Government funds provided under this Agreement must be allocated by the Recipient exclusively for the execution and operation of the Agreement Scope.

Government funds will not be utilized to support the Recipient's operations or administration unrelated to this Agreement.

5.2 Obligation. In no case shall the Government's financial obligation exceed the amount obligated on this Agreement or by amendment to the Agreement. The total amount estimated for performance of the Basic Agreement is $_____. Of this amount, the Government share is $_____ and the Recipient share is $_____. The total amount estimated for performance of the Option is $_____. Of this amount, the Government share is $_____ and the Recipient share is $_____. The amount of Government funds currently obligated and available for payment is $_____. It is estimated that such funds shall be sufficient to cover performance from date of agreement award through _____. The Government is not obligated to reimburse the Recipient for expenditures in excess of the amount of obligated funds allotted by the Government.

5.3 Incremental Funding. The Government may obligate funds to this Agreement incrementally. In the event that this Agreement is funded incrementally, the Government anticipates that from time to time additional amounts will be allotted to this agreement by unilateral modification, until the total amount for performance of this Agreement has been funded. To minimize interruption of effort due to lack of funds, the Recipient shall notify the Agreements Officer in writing whenever the amount of funds obligated under this agreement when added to anticipated costs in the next 60 days will exceed 75% of the amount allotted. Obligated funds provided to the Consortium for any Government fiscal year (GFY), which are not expended in the same GFY, may be carried forward and expended in the next succeeding GFY until they are completely expended.

5.4 Cost Share. The Government and Recipient estimate that the Scope of this agreement can only be accomplished with a total aggregate resource contribution of $_____ for the Basic Agreement, and a total resource contribution of $_____ for the Option. For the purposes of this Agreement, the cost share ratio for the Basic Agreement shall be $_____ Government and $_____ Recipient, and $_____ Government and $_____ Recipient for the Option. The Recipient intends, and by entering into this Agreement, undertakes to cause this cost share to be provided. The Recipient's contributions will be provided as detailed in the IPP and subsequent BPPs under this Agreement. Failure of either Party to provide its contribution may result in termination of this agreement, or a proportional reduction in funding.

5.5 Payments.

- The Recipient will submit an original and two (2) copies of all vouchers (SF 270 "Request for Advance or Reimbursement") to the Agreement Administrator listed in Article 8.2, and one (1) copy to the CAM for payment approval. After written verification of progress towards or achievement of the research milestones by the CAM, and approval by the Agreement Administrator, the vouchers will be forwarded to the payment office within ten (10) calendar days of receipt of the voucher. Payments will be made via EFT by the Payment Office listed in Article 8.4, within 20 calendar days of receipt of transmittal.

- Payments will be made no more frequently than monthly and will be based on reimbursement of actual expenditures as monitored against the Budget Plan contained in the IPP/APP. Once the CAM has verified that the Recipient has expended best efforts towards the successful achievement of the research goals, payment will be authorized.

ARTICLE 6 AGREEMENT ADMINISTRATION

6.1 Modifications to this Agreement. Any Party who wishes to modify this Agreement will, upon reasonable notice of the proposed modification to the other Party, confer in good faith with the other Party

to determine the desirability of the proposed modification. Modifications will not be effective until a written modification is signed by the Agreement signatories or their successors. Administrative modifications may be unilaterally executed by the Grants Officer or by the Agreements Administrator.

6.2 Requirements for Approval for Changes to the Program Budget and Program Plan. This provision highlights Agency decisions on the terms and conditions of 32 CFR 32.25 and 32 CFR 34.15 as applicable. During the course of performance, the Grants Officer, in coordination with the CAM, will have approval authority for certain specific changes to the IPP/APP including but not limited to:

- Changes in the scope or the objective of the program, IPP/APP, or research milestones;
- Change in the key personnel specified in the IPP/APP or a change in MAST Program Director or any of the Research Center Directors;
- The absence for more than three months, or a 25% reduction in time devoted to the project, by the approved project director or principal investigator;
- The need for additional Federal funding; and
- Any sub-award, transfer, or contracting out of substantive program performance under an award, unless described in the IPP/APP.

The CAM, in coordination with the CMC and ARL management, will be responsible for integrating the IPP/APP into the overall respective research and technology programs.

During the course of performance, the Grants Officer, in coordination with the CAM, will have approval authority for certain specific changes to the cooperative agreement including, but not limited to:

- Changes to the Articles of Collaboration if such changes substantially alter the relationship of the parties as originally agreed upon;
- Solicitation or acceptance of funding under the agreement from sources other than ARL; and
- Changes in Consortium membership.

6.3 No-Cost Period of Performance Extension. In accordance with the DoD Grant and Agreement Regulations (DoD 3210.6-R), the Recipient may initiate a request for a one-time, no-cost extension to the period of performance. The request may not include additional Federal funds, nor change the approved objectives or scope of the program.

ARTICLE 7 TERM OF THE AGREEMENT

The term of the Basic Agreement will commence upon the effective date and continue through five years. The term of the Option, if exercised, will commence upon the effective date of the modification exercising the option and continue through five years. The Option may be exercised at any time prior to completion of the Basic Agreement.

ARTICLE 8 ADMINISTRATIVE RESPONSIBILITY

8.1 THE AGREEMENTS OFFICE

U.S. Army RDECOM Acquisition Center
Research Triangle Park (RTP) Contracting Division
ATTN: AMSRD-ACC-R

For FedEx etc. use: 4300 S. Miami Blvd., Durham, NC 27703
For USPS use: P.O. Box 12211, Research Triangle Park, NC 27709

Grants Officer:	Agreement Specialist:
Phone: (919) 549-	Phone: (919) 549-
Fax: (919)549-4373	Fax: (919) 549-
Email:	Email:

8.2 AGREEMENT ADMINISTRATOR

8.3 THE RECIPIENT ADDRESS AND POINT OF CONTACT

8.4 THE PAYMENT OFFICE

8.5 ADDRESS OF PAYEE

ARTICLE 9 PUBLIC RELEASE OR DISSEMINATION OF INFORMATION

9.1 Open Publication Policy. Notwithstanding the reporting requirements of this Agreement, parties to this Agreement favor an open-publication policy to promote the commercial acceptance of the technology developed under this Agreement, but simultaneously recognize the necessity to protect proprietary information.

9.2 Prior Review of Public Releases. The Parties agree to confer and consult with each other prior to publication or other disclosure of the results of work under this Agreement to ensure that no classified or proprietary information is released. Prior to submitting a manuscript for publication or before any other public disclosure, each Party will offer the other Party ample opportunity (not to exceed 60 days) to review such proposed publication or disclosure, to submit objections, and to file application letters for patents in a timely manner.

9.3 Publication Legend. It is herein agreed that except for the disclosure of basic information regarding this Agreement such as membership, purpose and a general description of the technical work, the Recipient will submit all proposed public releases to the ARL cooperative Agreement Manager for comment prior to release. Public releases include press releases, specific publicity or advertisement, and articles for proposed publication or presentation. In addition, articles for publication or presentation will contain an acknowledgement of support and a disclaimer. This should be included to read as follows. These statements may be placed either at the bottom of the first page or at the end of the paper. “Research

was sponsored by the Army Research Laboratory and was accomplished under Cooperative Agreement Number W911NF-07-2-____. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of the Army Research Laboratory or the U.S. Government. The U.S. Government is authorized to reproduce and distribute reprints for Government purposes notwithstanding any copyright notation heron."

ARTICLE 10 INTELLECTUAL PROPERTY

In addition to the Intellectual Property Rights contained in 32 CFR 32.36 or 32 CFR 34.25 as applicable, incorporated by reference into this Agreement, the participants recognize that this program may result in intellectual property that is generated jointly by the Recipient or Sub-Recipient personnel and Government personnel. Should this occur, the parties agree to use their best efforts to mutually agree to an equitable distribution of property rights and distribution of filing fees or other administrative costs. Should the parties reach an impasse in determining the distribution of property rights, the parties shall resort to the Disputes, Claims, and Appeals Process as set forth at 32 CFR 22.815.

ARTICLE 11 ENTIRE AGREEMENT

This Agreement along with all Attachments constitutes the entire agreement between the parties concerning the subject matter hereof and supersedes any prior understandings or written or oral agreement relative to said matter. In the event of a conflict between the terms of the Agreement and its attachments, the terms of the Agreement shall govern.

ARTICLE 12 GOVERNING LAW/ORDER OF PRECEDENCE

The Agreement shall be enforced in accordance with applicable federal law and regulations, directives, circulars or other guidance as specified in this Agreement. When signed, this Agreement shall become binding on the Recipient and the Government to be administered in accordance with the DoD Grant and Agreement Regulations as they apply to the particular recipient or sub-recipient concerned. In the event a conflict exists between the provisions of this Agreement and the applicable law, regulations, directives, circulars or other guidance, the Agreement provisions are subordinate.

ARTICLE 13 WAIVER OF RIGHTS

Any waiver of any requirement contained in this Agreement shall be by mutual agreement of the parties hereto. Any waiver shall be reduced to writing and a copy of the waiver shall be provided to each Party. Failure to insist upon strict performance of any of the terms and conditions hereof, or failure or delay to exercise any rights provided herein or by law, shall not be deemed a waiver of any rights of any Party hereto.

ARTICLE 14 USE OF TECHNICAL FACILITIES

To the maximum extent practical, the Recipient agrees to use the technical reference facilities of the Defense Technical Information Center, 8725 John J. Kingman Road, Suite 0944, Ft. Belvoir, VA 22060-6218 (Internet address: http://www.dtic.mil) and all other sources, whether United States Government or private, for purpose of surveying existing knowledge and avoiding needless duplication of scientific and engineering effort.

ARTICLE 15 METRIC SYSTEM OF MEASUREMENT

The Metric Conversion Act of 1975 as amended by the Omnibus Trade and Competitiveness Act of 1988 and implemented by Executive Order 12770 gives preference to the metric system. The Recipient shall ensure that the metric system is used to the maximum extent practicable in performance of this Agreement.

ARTICLE 16 LIABILITY

No Party to this Agreement shall be liable to any other Party for any property of that other Party consumed, damaged, or destroyed in the performance of this Agreement, unless it is due to the negligence or misconduct of the Party or an employee or agent of the Party.

ARTICLE 17 NON-ASSIGNMENT

This Agreement may not be assigned by any Party except by operation of law resulting from the merger of a party into or with another corporate entity.

ARTICLE 18 SEVERABILITY

If any clause, provision or section of this Agreement shall be held illegal or invalid by any court, the invalidity of such clause, provision or section shall not affect any of the remaining clauses, provisions or sections herein and this Agreement shall be construed and enforced as if such illegal or invalid clause, provision or section had not been contained herein.

ARTICLE 19 FORCE MAJEURE

Neither Party shall be in breach of this Agreement for any failure of performance caused by any event beyond its reasonable control and not caused by the fault or negligence of that Party. In the event such a force majeure event occurs, the Party unable to perform shall promptly notify the other Party and shall in good faith maintain such partial performance as is reasonably possible and shall resume full performance as soon as is reasonably possible.

ARTICLE 20 NOTICES

All notices and prior approvals required hereunder shall be in writing and shall be addressed to the parties identified on the Agreement cover page and Article 8. Notices shall be effective upon signature of the Grants Officer.

ARTICLE 21 - ACCESS GUIDANCE.

Should a Recipient's performance require access to DoD facilities, the employer shall coordinate with their CAM or designated point of contact providing access in order to obtain the most current access guidance. Commencement of access coordination should occur at least 10 days prior to the date of required access.

ATTACHMENT 1

Standard Terms and Conditions for Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations Department of Defense Grant and Agreement Regulations (DoDGARS) (DoD 3210.6-R and 32 CFR Parts 21-37

Award, administration and performance under this agreement is subject to the requirements of the DoD Grant and Agreement Regulations (32CFR Parts 21-37). Narratives following a reference indicate the Agency's decision on specific issues.

- **32 CFR 22.815 Claims, Disputes and Appeal**

  The Agency and Recipient will employ Alternative Dispute Resolution to resolve issues which arise during the performance of the agreement. The procedures to be used will be mutually agreed to when and if issues arise (see section 815(c)(2)). The Grant Appeal Authority is the Director of ARL (see section 815(e)(i)).

- **32 CFR 32.21 Standards for Financial Management Systems**

  ARL does not guarantee or insure the repayment of money borrowed by the recipient. Further, ARL does not require the recipient to secure fidelity bond coverage to protect the Government's interests.

- **32 CFR 32.22 Payment**

  All payments made under this agreement will be of the reimbursement type. Recipients should refer to Article 5 Fiscal Management of this agreement for further information.

- **32 CFR 32.27 and 32.28 Allowable Costs**

  The Recipient shall comply with the appropriate cost principles.

- **32 CFR 32.23 Cost Share or Match**

  This provision is applicable only if cost share or match is included in the recipient's proposal and the subsequent award document. Should cost share or match be included, the parties to this agreement will mutually agree to its allowability, valuation and necessary documentation.

- **32 CFR 32.24 Program Income**

  Should this agreement result in generating program income, the recipient shall account for said funds, add them to the funds committed to the project, and they shall be used to further the program objectives. The recipient shall have no obligation to the Government for program income earned after the expiration of the program. Costs incident to the generation of program income may be deducted from gross income to determine program income, provided these costs have not been charged to the award document. The Patent and Trademark Amendments (35 U.S.C. Chapter 18) apply to inventions made under this award.

- **32 CFR 32.25 Revision of Budget/Program Plans**

  See Article 6 of this agreement.

- **32 CFR 32.26 Audit**

  Non-Profit entities shall submit a copy of the OMB Circular A-133 audit reports to the DoD Inspector General and to the Grants Officer.

- **32 CFR 32.40 through 32.49 Procurement**

  ARL reserves the right to review prior to award procurement documents such as request for proposals, or invitations for bids, independent cost estimates etc., during performance under this award.

- **32 CFR 32.5 Sub-awards**

This subpart sets forth the requirement for flow down provisions or subsequent sub-agreements or sub-awards.

- **32 CFR 32.30 through 32.37 Property**

ARL waives the requirement for recordation of liens or other appropriate notices set forth at 32 CFR 32.37.

Recipients are subject to applicable regulations governing patents and inventions, including Government-wide regulations issued by the Department of Commerce at 37 CFR part 401 "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements."

ARL does not waive the right to obtain, reproduce, publish or otherwise use the data first produced under this award or to authorize others to receive, reproduce, publish, or otherwise use such data for government purposes.

- **32 CFR 32.51 and 32.52 Reports**

See Attachment 5 of this agreement.

- **32 CFR 32.53 Records**

- **32 CFR 32.60 through 32.62 Termination and Enforcement**

In addition to the termination processes set forth in 32 CFR 32.61, this Agreement may also be terminated by the Grants Officer should available funds be insufficient to accomplish the goals or intent of the Agreement, or convenience of the Government.

- **32 CFR 32.71 through 32.73 After-the-Award Requirements**

ATTACHMENT 2

Standard Terms and Conditions Applicable to For-Profit Entities
Department of Defense Grant and Agreement Regulations (DoDGARS)
DoD 3210.6-R and 32 CFR Parts 21-37

Award, administration, and performance under this agreement is subject to the requirements of the DoD Grant and Agreement Regulations (32 CFR Parts 21 – 37). The following references indicate the awarding agency's decision on specific issues.

32 CFR 34.1(b)(2)(ii) Sub-Awards

For-profit organizations that receive prime awards covered by this part shall apply to each sub-award the administrative requirements that are applicable to the particular type of sub-recipient (see 32 CFR parts 32 and 34)

32 CFR 34.11 Standards for Financial Management Systems

The Agency does not guarantee or insure the repayment of money borrowed by the Recipient (see section 11(b)). Fidelity bond coverage is not required (see section 11(c)).

32 CFR 34.12 Payment

This Agreement will employ the reimbursement method of payment (see 32 CFR 34.12(a)(1)). This Agreement does not provide for advance payments (see section 12(a)(2)). (See Article 5, subparagraphs 5.1.2 through 5.1.4) . See Article 5 – Fiscal Management for specifics concerning the payment process.

32 CFR 34.13 Cost Share or Match

This provision is applicable only if cost share or match is proposed. Should cost share or match be included, the parties to this agreement will mutually agree to its allowability, valuation, and necessary documentation.

32 CFR 34.14 Program Income

Should this agreement result in the generation of program income, the recipient shall account for said funds, add them to the funds committed to the project, and they shall be used to further the program objectives. The recipient shall have no obligation to the Government for program income earned after the expiration of the program. Costs incident to the generation of program income may be deducted from gross income to determine program income, provided these costs have not been charged to the award document. The Patent and Trademark Amendments (35 U.S.C. Chapter 18) apply to inventions made under this award.

32 CFR 34.15 Revision of Budget/Program Plans

See Article 6 of this agreement.

32 CFR 34.16 Audit

For profit Recipient(s) of this award are required to submit audit reports to the following address:

Grants Officer: Patricia J. Fox
Phone: (919) 549-4272
Fax: (919) 549-4373
Email: patricia.fox@us.army.mil

Agreement Administrator:
DCMA Central Pennsylvania, York
PO Box 15512
York, PA 17405-1512

DCAA Silver Spring Branch Office
20251 Century Blvd., Suite 320
Germantown, MD 20874
Phone No: 301-601-6130
Fax No: 301-353-1518

Other:
Audit reports may be requested from the DoD Inspector General, or any of the Department of Army Policy directorates.

32 CFR 34.17 Allowable Costs

The For-Profit costs principles in 48 CFR parts 31 and 231 (Federal Acquisition Regulation and Defense Acquisition Regulations Supplement) as well as the supplemental information on allowability of audit costs in the 32 CFR 34.16(f) are applicable.

32 CFR 34.18 Fee/Profit

This Agreement does not provide for the payment of fee/profit to the recipient or subrecipients.

32 CFR 34.20 through 34.25 Property Standards

For-Profit Recipients may only purchase real property and equipment under this Agreement with the prior approval of the Grants Officer. Government approved Program Plans that include a budget indicating real property or equipment purchases will provide sufficient evidence of the required Grants Officer approval.

The Recipient receives conditional title to all real property and equipment purchased under this Agreement. ARL reserves the right to transfer title to any and all equipment or real property purchased under this Agreement to the Federal Government or to eligible third parties upon conclusion of this Agreement.

For-Profit organizations other than small business concerns shall comply with 35 U.S.C. 210(c) and Executive Order 12591 (3 CFR, 1987 Comp., p.220) which codifies a Presidential Memorandum on Government Patent Policy dated February 18, 1983.

ARL reserves the right to obtain, reproduce, publish, or otherwise use for Federal Government purpose the data first produced under this award, and authorize others to receive, reproduce, publish, or otherwise use such data for Federal purposes.

32 CFR 34.30 through 34.31 Procurement Standards

ARL reserves the right to review prior to award procurement documents such as request for proposals, or invitations for bids, independent cost estimates etc., during performance under this award. (see 32 CFR 34.31(b))

32 CFR 34.41 Reports

See Attachment 5 of this Agreement.

32 CFR 34.42 Records

32 CFR 34.50 through 34.52 Termination and Enforcement

In addition to the termination processes set forth at 32 CFR 34.51, this Agreement may also be terminated by the Grants Officer should available funds be insufficient to accomplish the goals or intent of the Agreement, or other convenience of the Government.

32 CFR 22.815 Claims, Disputes and Appeal

The Agency and Recipient will employ Alternative Dispute Resolution to resolve issues which arise during the performance of agreement. The Agency and Recipient recognize that disputes arising under this agreement are best resolved at the local working level by the parties directly involved. All Parties are encouraged to be imaginative in designing mechanisms and procedures to resolve disputes at this level. Any dispute arising under the agreement, which is not disposed of by agreement of the parties at the working level shall be submitted jointly to a senior manager of Agency and Recipient or their

designee(s) for resolution (see section 815(c)(2)). The Grant Appeal Authority is the Director of Agency (see section 815(e)(2)). Pending the resolution of any dispute or claim pursuant to this Article, the Parties agree that performance of all obligations shall be pursued diligently in accordance with the Agreement.

32 CFR 34.61 through 34.63 After-the-Award Requirements

Appendix A to Part 34 – Contract Provisions

All contracts awarded by the Recipient, including those for amounts less than the simplified acquisition threshold, shall contain the following provisions as applicable:

- Equal Employment Opportunity (E.O. 11246, as amended by E.O. 11375, and supplemented by 41 CFR Chapter 60)

- Copeland "Anti-Kickback" Act (18 U.S.C. 874 and 40 U.S.C. 276c)
- Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333)
- Rights to Inventions Made Under a Contract, Grant, or Cooperative Agreement (37 CFR Part 401)
- Clean Air Act (42 U.S.C. 7401 et seq.) and the Federal Water Pollution Control Act (33 U.S.C. 1251 et. seq.)
- Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)
- Debarment and Suspension (E.O.s 12549 and 12689)

ATTACHMENT 3
National Policy Requirements

By signing this Agreement or accepting funds under this Agreement, the recipient assures that it will comply with applicable provisions of the national policies on the following topics:

1. NONDISCRIMINATION

a. On the basis of race, color, or national origin, in Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d, et seq.), as implemented by DoD regulations at 32 CFR part 195.
b. On the basis of sex or blindness, in Title IX of the Education Amendments of 1972 (20 U.S.C. 1681, et seq.). (Applicable to Educational Institutions only)
c. On the basis of age, in the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.), as implemented by Department of Health and Human Services regulations at 45 CFR part 90.
d. On the basis of handicap, in Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794), as implemented by Department of Justice regulations at 28 CFR part 41 and DoD regulations at 32 CFR part 56.

2. Live Organisms. For human subjects, the Common Federal Policy for the Protection of Human Subjects, codified by the Department of Health and Human Services at 45 CFR part 46 and implemented by the Department of Defense at 32 CFR part 219.

3. Environmental Standards.

a. Comply with the applicable provisions of the Clean Air Act (42 U.S.C. 7401, et. Seq.) and Clean Water Act (33 U.S.C. 1251, et. seq.), as implemented by Executive Order 11783 [3 CFR, 1971-1075 Comp., p. 799] and Environmental Protection Agency (EPA) rules at 40 CFR part 15. In accordance with the EPA rules, the Recipient further agrees that it will:

- Not use any facility on the EPA's List of Violating Facilities in performing any award that is nonexempt under 40 CFR 15.5, as long as the facility remains on the list.

- Notify the awarding agency if it intends to use a facility in performing this award that is on the List of Violating Facilities or that the Recipient knows has been recommended to be placed on the List of Violating Facilities.

b. Identify to the awarding agency any impact this award may have on the quality of the human environment, and provide help the agency may need to comply with the National Environmental Policy Act (NEPA, at 42 U.S.C. 4231, et. seq.) and to prepare Environmental Impact Statements or other required environmental documentation. In such cases, the recipient agrees to take no action that will have an adverse environmental impact (e.g., physical disturbance of a site such as breaking of ground) until the agency provides written notification of compliance with the environmental impact analysis process.

4. Officials Not to Benefit. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this Agreement or to any benefit arising from it, in accordance with 41 U.S.C. 22.

5. Preference for U.S. Flag Carriers. Travel supported by U.S. Government funds under this Agreement shall use U.S. -flag air carriers (air carriers holding certificates under 49 USC 41102) for international air transportation of people and property to the extent that such service is available, in accordance with the International Air Transportation Fair Competitive Practices Act of 1974 (49 USC 40118) and the interpretative guidelines issued by the Comptroller General of the United States in the March 31, 1981, amendment to the Comptroller General Decision B138942.

6. Cargo Preference. The recipient agrees that it will comply with the Cargo Preference Act of 1954 (46 U.S.C. 1241), as implemented by Department of Transportation regulations at 46 CFR 381.7, which require that at least 50 percent of equipment, materials or commodities procured or otherwise obtained with U.S. Government funds under this agreement, and which may be transported by ocean vessel, shall be transported on privately owned U.S.-flag commercial vessels, if available.

7. Military Recruiters. As a condition for receipt of funds available to the Department of Defense (DoD) under this award, the recipient agrees that it is not an institution of higher education (as defined in 32 CFR part 216) that has a policy of denying, and that it is not an institution of higher education that effectively prevents, the Secretary of Defense from obtaining for military recruiting purposes: (A) entry to campuses or access to students on campuses; or (B) access to directory information pertaining to students. If the recipient is determined, using the procedures in 32 CFR part 216, to be such an institution of higher education during the period of performance of this agreement, and therefore to be in breach of this clause, the Government will cease all payments of DoD funds under this agreement and all other DoD grants and cooperative agreements to the recipient, and it may suspend or terminate such grants and agreements unilaterally for material failure to comply with the terms and conditions of award.

ATTACHMENT 4
Other Certifications

The following Certifications, which have been executed by the Recipient prior to award of this Agreement are on file with the issuing office, and are hereby incorporated herein by reference:

a. Certification at Appendix A to 32 CFR Part 28 Regarding Lobbying
b. Certification at Appendix A to 32 CFR Part 25 Regarding Debarment, Suspension, and Other Responsibility Matters
c. Certification at Appendix C to 32 CFR Part 25 Regarding Drug-Free Workplace Requirements

ATTACHMENT 5 Annual Program Plan and Budget

ANNUAL PROGRAM PLAN

(TO BE COMPLETED IN ACCORDANCE WITH ARTICLE 3.)

ATTACHMENT 6

Reporting Requirements

1. QUARTERLY REPORT - Throughout the term of the agreement, the recipient shall submit or otherwise provide a quarterly report (government fiscal quarter). Two (2) copies shall be submitted or otherwise provided to the cam, and one (1) copy shall be submitted or otherwise provided to the agreements administration office. A copy of the letter of transmittal shall be submitted or otherwise provided to the agreements office. The report shall contain two (2) major sections**:**

- Technical Status Report. The technical status report will detail technical progress to date on research milestones, all problems, technical issues or major developments during the reporting period, as well as technology transition opportunities. The technical status report will include a report on the status of the collaborative activities during the reporting period. The technical status report will include the utilization of subject inventions by the Recipient.

- Business Status Report. The business status report will provide summarized details of the resource status of this Agreement, including the status of contributions by the Recipient. This report should compare the resource status with any payment and expenditure schedules or plans provided in the original agreement. Any major deviations shall be explained along with discussion of adjustment actions proposed.

2. JOINT PAPERS AND PRESENTATIONS: Periodic joint papers and presentations will be given if/when determined necessary by the CAM.

3. JOURNAL ARTICLES: Journal articles in general and joint arl/recipient journal articles are strongly encouraged as a major reporting mechanism of this research effort**.**

4. ANNUAL AND FINAL REPORTS

- The Recipient shall submit an Annual Report making full disclosure of all major technical developments and progress for the preceding 12 months of effort within sixty (60) calendar days of completion of the effort and for each additional 12 months of effort, through the life of this agreement. The report will also provide an accounting of all Federal funds expended during the term of the Agreement. With the approval of the Cooperative Agreement Manager, reprints of published articles may be attached to the Final Report.

- The Recipient shall make distribution of the Final report as follows:

Cooperative Agreement Manager - 1 original plus 1 copy;
Agreement Administration Office - 1 copy, and the
Grants Officer - 1 copy of the letter of transmittal only.
One (1) copy of the Final Report shall be provided to:

Defense Technical Information Center (DTIC)
8725 John J. Kingman Road, Suite 0944
Ft. Belvoir, VA 22060-6218